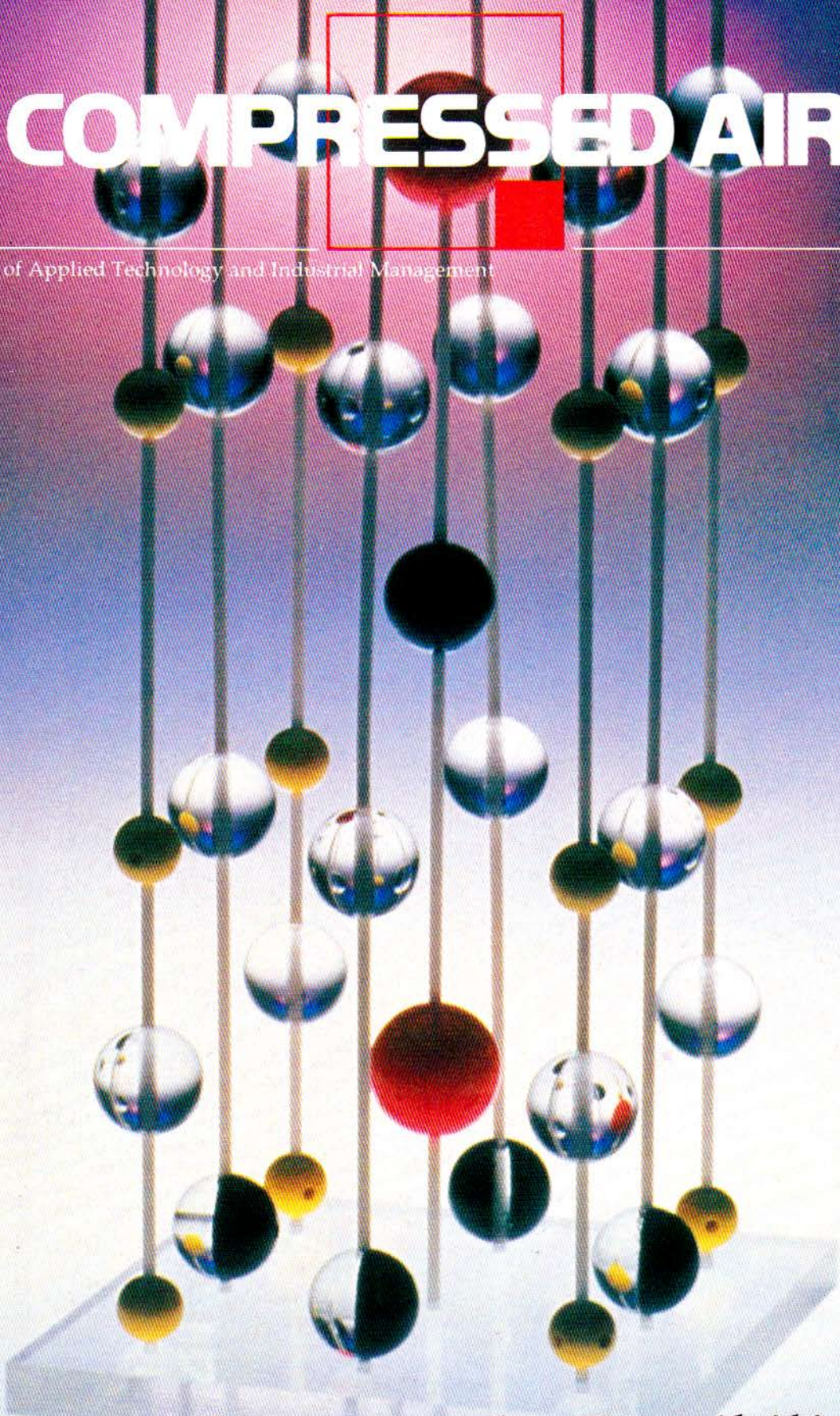
COMPRESSED AIR

A Magazine of Applied Technology and Industrial Management

March 1988



Superconductors: the Possibilities

PICTURE PHONES: THE RACE IS ON

WARBIRDS: SALVAGING HISTORY

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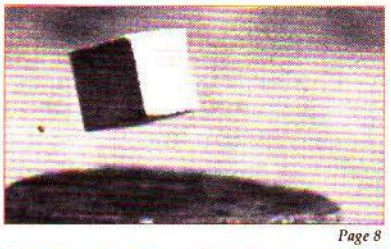

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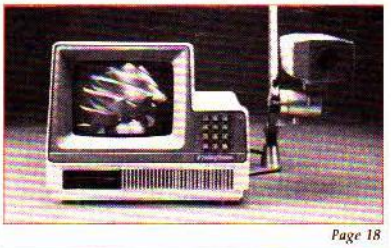

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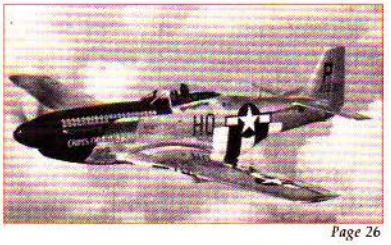

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DEPARTMENTS

ABOUT THE COVER

This month's cover picture shows a model of the crystal structure of the high-temperature superconducting material yttrium-barium-copper-oxide. The article on page 8 describes the 77-year-old overnight success of superconductors; the story on page 11 looks at some current attractions.

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Warbirds—Endangered Species?

Photographed for the EAA Warbirds of America, Jim Koepnick's pictures show, from the left, an F4U Corsair (foreground),

Last August 23, a World War II Boeing B-17 bomber overshot the runway at Beaver County Airport, 30 miles northwest of Pittsburgh, Pa., and lumbered down an embankment. Once the pride of the 8th Air Force, the plane now nested unceremoniously at the base of a 100-foot bank, brought down by a sudden gust of wind. The damage was significant, and the warbird, one of the few survivors of nearly 13,000 of its kind built during the late 1930s and '40s, might have made its last flight. But no. There were those who would not let this mighty warplane meet such an ignominious end.

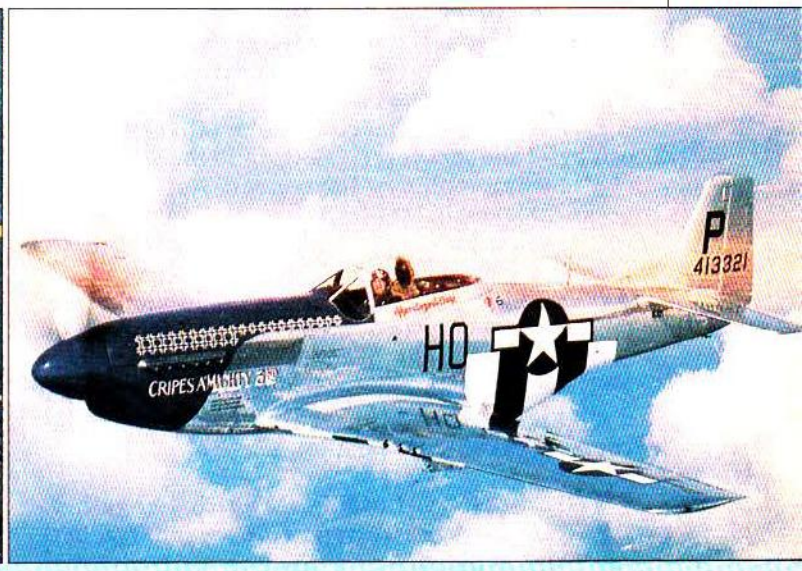
The damaged B-17, valued at $1,000,000 and owned by Collings Trust of Stow, Mass., stirred the hearts of nearly a hundred volunteers—some ex-servicemen with firsthand memories of the plane, some pilots and aircraft mechanics, but all admirers of the plane, its history, and its importance to our nation's aviation heritage. Less than 2 weeks after the crash, a crew of volunteers began working 12 hours a day, 7 days a week, to restore the aircraft. Off-duty USAir and other mechanics are providing their expertise; machinists are making parts; companies are supplying such hard-to-find pieces as rivets; and helpers of all ages are giving their time. If all goes well, the B-17 should be ready again by the summer of 1988.

This response to the preservation of American aviation artifacts, particularly warbirds, is encouraging, admirable, and vital to our learning and understanding of our recent past. Fortunately, it is not rare. There are currently thousands of players, representing the military, public and nonprofit institutions, and private and commercial interests, in a global scenario of warbird recovery, restoration, and display.

The total warplanes produced numbers in the hundreds of thousands—the estimate for World War II, worldwide, is approximately 950,000. Considering that there were approximately 297,000 warplanes made in the United States between 1939 and 1945, that many warbirds survived the First World War, and that most countries have operated or maintained combat aircraft throughout the same periods, we should be tripping over these planes. But, for a variety of reasons, flyable and/or displayable examples of most warbirds are scarce. Where they all went (and in some lucky cases, where some still are) is a mixed story, not of malicious destruction, but of fate and expediency.

First of all, the reality of war claimed a great number of aircraft. Individual kills and crashes (including training accidents), and mass attacks,

Public Institutions, the Military, and Private Collectors Are Recovering, Restoring, and Displaying Historic Warplanes Lest We Forget Their Roles in Forging World History.



a P-51A (middle ground), and a P-51D (background); a T-28B; and on this page, a Navy SNJ and an RCAF T-6; and a P-51D.

such as that on Pearl Harbor, reduced the inventory. But many warplanes were also lost to attrition and peacetime maintenance demands.

Following World War I, the 'birds of that era—wood and fabric affairs—were ravaged by time and the elements. Deterioration took place even when they were kept in storage, which was not de rigueur at the time. Abandoned at crash sites, left in buildings on military bases, or stored in and behind barns and hangers of private airfields, these aircraft rotted away, were cannibalized for parts and trophies, and slowly disappeared. Collectors with personal and/or vested interests in preserving them were fighting an uphill battle.

Following World War II, the scene was different, but the results pretty much the same. The military was overstocked and, as is the essence of a dynamic defense, new models with new technology were constantly replacing the obsolete. There are stories of aircraft carrier crews, returning from the Pacific, who pushed their planes into the sea. They were no longer needed and were simply so much ballast. Also, there were few places for them at home. Smelters were running around the clock at places like San Diego and Hawaii, melting down planes for the metal. Some reports speak of barges loaded with planes being scuttled offshore, in the oceans, the Great Lakes, and elsewhere.

There are also tales of which salvors' dreams are made, concerning islands, ice floes, and jungles, where countless warbirds are parked, propeller-to-tail, left behind as silent reminders of a war we were glad to put behind us. How many of these tales are true, how many are myths, no one can say. It is surely probable that caches of military materiel were indeed left where they lay; however, accounts of such caches can grow faster than rust on landing gear.

Myths aside, the reality of the late 1940s and early '50s is that World War II planes were being quickly depleted. Two elements—the emergence of jet technology and the Korean conflict—added to the rapid depletion. The new technology, which began during the Second World War, rang the death knell for piston-engined warbirds. And when fighting began in Korea, the pipeline filled with modern machines. While some piston-engined planes were kept for trainers, many were disposed of at auction. Planes that demand 6-figure prices from collectors today were often sold in flying condition for as little as $1500 on the civilian block.

During the war itself, aircraft were also provided to the Allies. America delivered 14,000 lend-lease

planes to the Soviet Union alone. After the war, the United States gave many World War II aircraft to friendly emerging nations to assist them in developing air defense systems. In all, the warbirds that wrote the history of World War II were pushed from the nest in flocks. Once numerous, their numbers plummeted. And now, warbirds must be protected.

WARBIRD RECOVERY

Of warbird recovery, restoration, and display, recovery is the most challenging and mysterious. Locating them is, of course, the first step and is fraught with disappointments—a tree-shrouded P-40 turns out to be an old Piper—and dead ends. Those who go after warbirds are the repositories for half-rumors and local legends that grossly outweigh the legitimate leads.

Following a legitimate sighting, other problems can beset the recoverer. Getting to the site can be challenging—planes have been found in the ocean, in lakes, in jungles, in swamps, in the desert, and on mountaintops. In fact, most warbirds are found in extremely hostile environments, conditions that have kept them from being victimized. Once a plane is located, however, the environment can be joined in its hostility by the government and/or the inhabitants of the location. Thus, both domestic and foreign expeditions must have the cooperation of these people.

Then there is funding. The challenge here can spell the difference between recovery and avoidance of a downed warbird—even one of significance. Recovery can often be cost-prohibitive. While these costs can vary greatly, they are never small. Example: The Franklin Institute began offering its display Boeing 707 free in November of last year. However, the takers must pick it up. Now, getting to the site is no problem—it is in downtown Philadelphia. You could take a bus. Getting the 707 out, though, could cost up to $250,000 for towing . . . definitely not a typical AAA call, but better than getting a warbird out of the jungle, up from the ocean floor, or off a mountaintop. Raising the money to recover these warplanes is the concern of the military, public and private nonprofit organizations, aviation archeologists, and commercial operations. Each has a different approach, and different motivations. And since, by and large, most of the easy recoveries have been made, each must make major financial decisions.

To the USAF Museum, cost is an object. Founded in 1923 at McCook Field in Dayton, Ohio, it was relocated in 1971 to its present 400-acre site at historic Wright Field near Dayton. The museum, funded entirely by public contributions to the Air Force Museum Foundation, a private organization, now features more than 200 aircraft and major missiles. It is considered to be the largest and oldest military aviation museum in the world. But even for this prestigious operation, recovering a particular plane is a major decision.

Luckily, the museum has first pick from surplus Air Force offerings. Through the years, according to the museum's director, Col. Richard L. Uppstrom (USAF, Ret.), the memorabilia, artifacts, items, etc., acquired were obtained with a good bit of professional knowledge and foresight. "In our business, we have to learn to think about the future . . . what are we going to need to tell the story 25 or 50 years down the pike." A museum spokesman adds, "We are trying to get better at identifying and acquiring important items today rather than having some future museum director ask, 'I wonder why someone didn't bother to save such-and-such for display?'."

Advanced planning is necessary to make sure museum bids for aircraft are in early. "We have to get our bid in years in advance if we see something of specific historical importance," says curator Jack Hilliard. "We have found this to pay off since many important aircraft we now show were ordered years ago." For example, the museum reports that it will eventually receive President Kennedy's VC-137, more commonly known as "Air Force One" when the President is on board. This plane has been used by Presidents Nixon, Ford, Carter, and Reagan.

In addition to this type of acquisition, many of the museum's planes are on loan or have been donated by friends of the museum to fill a gap in the collection. To go to great expense to recover one itself is not government SOP. (In 1953, however, the United States did pay $100,000 to a North Korean defector for his MIG-15, a plane the government knew it wanted to see, especially in flying condition. Not only is the plane now on display, but so is the cancelled check.) The museum has a published want list, and as planes are received, the items are ticked off. Sometimes, wanted items are not forthcoming and the museum must go get them.

One more way of acquiring specific planes has been the research and on-site evaluation of planes that have crashed in remote areas. The museum's O-38 observation plane, for example, lay in the wilderness of Alaska for some 27 years before being salvaged in 1968. A Japanese Zero is another plane that found its way to the museum collection by being retrieved from Australia, after being picked up from a South Pacific island crash.

Public and private groups, who do not have the contacts of the USAF, are faced with more challenges. Among the many organized recovery operations are TIGHAR (pronounced "tiger"), The International Group for Historic Aircraft Recovery; the Experimental Aircraft Association's (EAA) Warbirds of America; and Warbird Salvors Inc., which is a commercial enterprise.

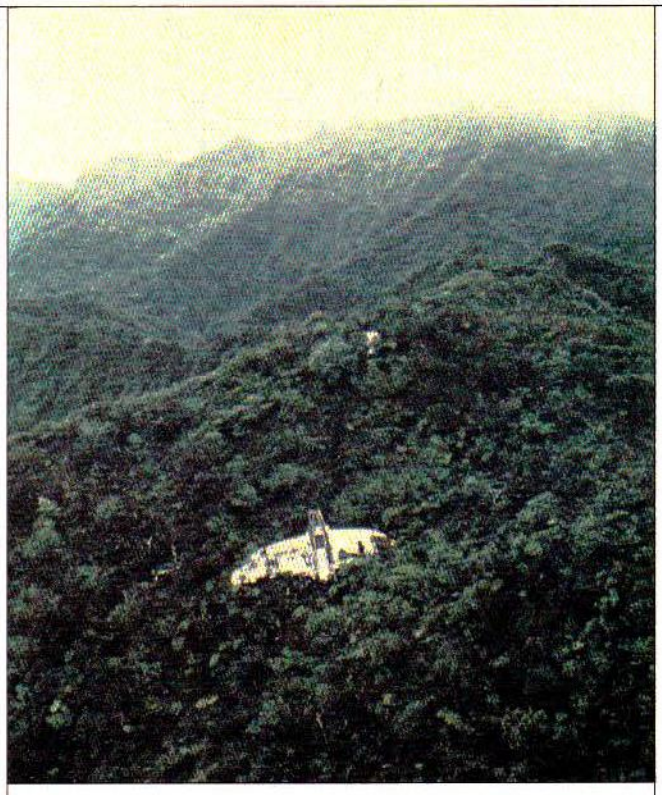
TIGHAR is a nonprofit foundation that, according to its executive director Richard E. Gillespie, "devotes its energies to the saving of endangered

historic aircraft wherever they may be found, and to the education of the international public in the need to responsibly preserve the relics of the history of flight." Based at Summit Airport, Middletown, Del., TIGHAR has an international membership of volunteers. Funding is solicited from individuals and corporations.

TIGHAR maintains no collection of its own and does not have a restoration operation. However, it compiles and verifies reports of rare and historic aircraft surviving in remote areas, and it conducts investigations and recovery expeditions in cooperation with museums and collectors worldwide.

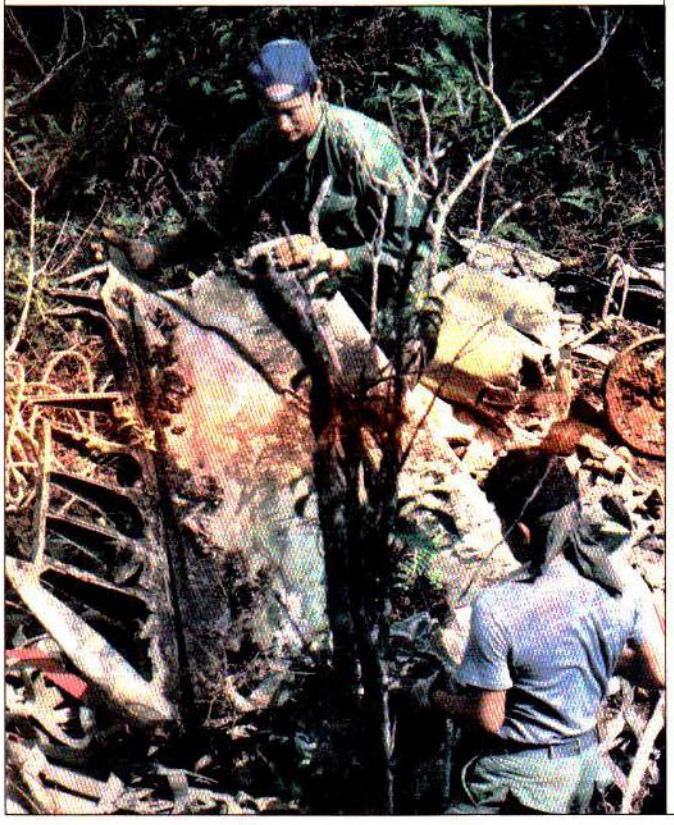
One current project is the attempt to recover a Flying Fortress, the B-17E #41-2446, from the Agaiambo Swamp in Papua New Guinea. In addition to the complexities of the physical task, the hostility of the natural environment, and the obstacle of inadequate funding, the foundation must wrestle with another challenge.

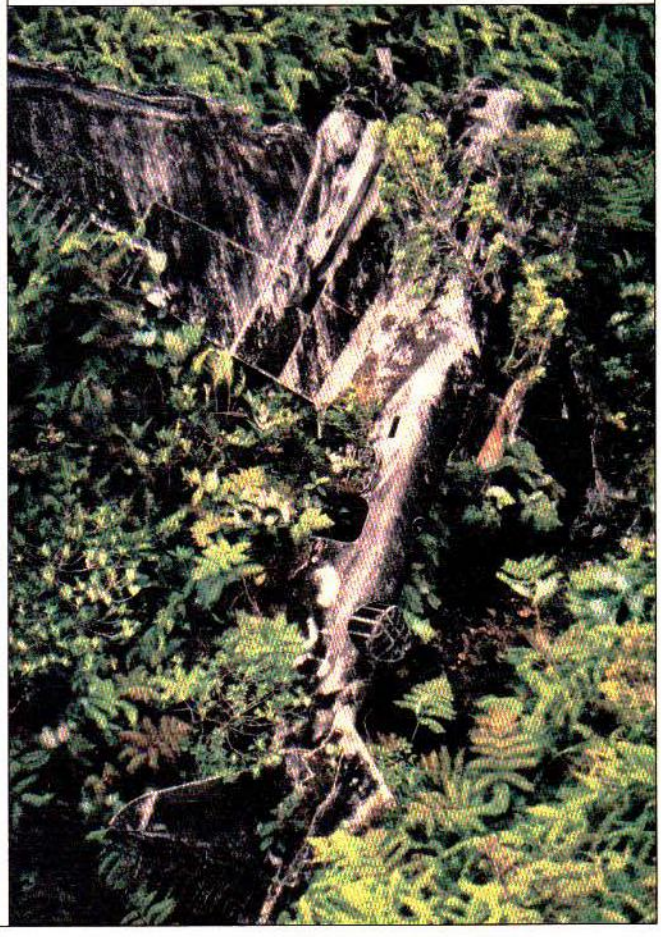
"The problem," says Gillespie, "has been the well-meaning but shortsighted policies of PNG's current administration, which holds all World War II relics to be national monuments that may not be removed." New Guinea contains vast numbers of World War II artifacts; however, Gillespie points to earlier forays to this country by collectors as the reason for the present negative feelings. From a different perspective, James Egan, president of Warbird Salvors Inc., believes that the government of Papua New Guinea also views crash sites as tour-



Hostile environments are often recovery sites. Warbird Salvors found a rare P-47 Thunderbolt perched on a Pacific island mountaintop (above), and an unusual B-18 Bolo bomber resting in a remote Hawaiian mountain range. The Bolo made a crash landing there in 1941, without a loss of life.

Warbird Salvors' crew members recover tail section of an unlucky Pearl Harbor defender, a rare P-40B Tomahawk.





ist attractions to be protected. Losing these would present an economic loss to the country.

Warbirds are not the only interest of TIGHAR. Currently the group is in its third year of searching the woods of Machias, Maine, for the rumored wreckage of *L'Oiseau Blanc*, the White Bird, one of several documented pre-Lindbergh Atlantic crossing attempts. This plane, flown by Francois Coli and Charles Nungesser, took off from Paris on 8 May 1927, just 12 days before Charles A. Lindbergh flew nonstop from New York to Paris. Competing for the same $25,000 prize for a Paris/New York flight as Lindbergh, the White Bird was scheduled to land in New York's harbor near the Statue of Liberty 40 hours later. But the plane and its 2-man crew were never seen after they left Paris.

Beyond recovery, restoration, and display, EAA Warbirds of America is a group of several thousand members with a common dream—"Keep 'em Flying." According to Jeffery Ethell, editor of *Warbirds* magazine and a recognized authority on military aircraft, "The dream machines of the past—the legendary trainers, fighters, bombers, and transports that kept the world free—are alive and active, thanks to a dedicated group of pilots, restorers, and enthusiasts who comprise the EAA Warbirds of America. For many in aviation, these fine aircraft represent the ultimate dream." Keeping the dream alive is today's mission for the Mustangs, Tomahawks, Hellcats, Flying Fortresses, Lightnings, Corsairs, Mitchells, PT-17s, T-6s, Wildcats, Bearcats, and dozens of other rare planes owned and flown by EAA Warbird members.

Vultee BT-13 (EAA photo by Carl Schuppel)

In terms of recovery and restoration, EAA Warbirds is a collection of private owners/enthusiasts who tackle the problems of maintaining these aircraft themselves. The group gives these people an organized voice and provides help with problems, such as the lack of vital aircraft components, lack of facilities, service, insurance, and other challenges to the owners of military aircraft.

B-25 (EAA photo by Jeffrey Isom)

B-17 Flying Fortress (EAA photo by Jeffrey Isom)

Located at Wittman Field, Oshkosh, Wisc., EAA Warbirds is a division of the Experimental Aircraft Association, which has assembled the world's largest private collection of planes. Many of the more than 200 machines in the collection are housed in the association's Air Adventure Museum. The group also stages major Fly-Ins, which give owners and enthusiasts the opportunity to see the warbirds, both in the air and on the ground. The last EAA event, "Oshkosh '87," saw 336 warbirds on the flight line.

THE INVESTOR/COLLECTOR

A relatively new player on the warbird scene is the investor/collector, and supporting him is a new and fast-growing industry—commercial aircraft salvage. In the forefront of the commercial salvors is Warbird Salvors Inc., of Alexandria, Va. James Egan, the company's president, views this new market as a saving grace for the thousands of recoverable planes worldwide.

"Warbird owners of the '60s and '70s," says Egan, "were, in large part, ex-military pilots or other World War II veterans with personal attachments to these aircraft. Often, ownership was an extension of their natural, finely tuned skills and interests. While many of these men have stopped flying, a new crop of owners is emerging, spurred by

historical and investment interests. This new market is larger and younger than ever before and is comprised to a large extent of new, young money. This second-generation market shares a love of machinery, plus a perception of warbirds as functional art. In fact, acquiring this new type of collectible is fast becoming the latest status symbol. Furthermore, authentic warbirds consistently appreciate in value and could well become the next 'precious metal.' Many of the individuals in this new market are reaching beyond exotic cars as status symbols and are embracing warbirds."

This functional art is now reaching fine-art prices, too. In the early 1960s, dealing in warbirds was still a buyer's market (Canada, for example, in 1961, sold its newly rebuilt Mustangs for about $1000 each). However, in 1983, Christie's, the London-based fine-arts dealers, received $390,000 for a 1943 Supermarine Spitfire LF MkIXB—at that time, the highest price ever recorded for an antique aircraft. The auction in Duxford, England, also saw American Kermit Weeks cheerfully part with $125,000 for a 1943 Hawker Tempest II that would take maybe an additional $100,000 to make airworthy. In all, that one auction took in more than a million dollars from a field of about 50 antique planes (not all were bought, either). A new era had definitely arrived.

Kermit Weeks is a good example of the new breed of warbird enthusiast. A successful businessman, the young American (he was 29 in 1983) maintains the Weeks Air Museum in Miami. There, he is assembling one of the largest, individually owned, collections of warbirds. But while he represents the new market in age and affluence, Weeks is unique in that he spends a good deal of time at his avocation. Other owners and potential owners must take care of business, while leaving the recovery and restoration to professional agents. This is where operations such as Warbird Salvors come in.

President James Egan is a businessman who fits the description of his company's clientele. Born after the war, Egan was introduced to warbirds by accident when he came upon the wreckage of a P-47 Thunderbolt while spearfishing in Hawaii. This was a particularly rare find since it is estimated that only four out of the 14,000-plus P-47s produced are flying today. His interest and entrepreneurial spirit raised, he examined the industry and now devotes all his efforts to locating and recovering antique military aircraft.

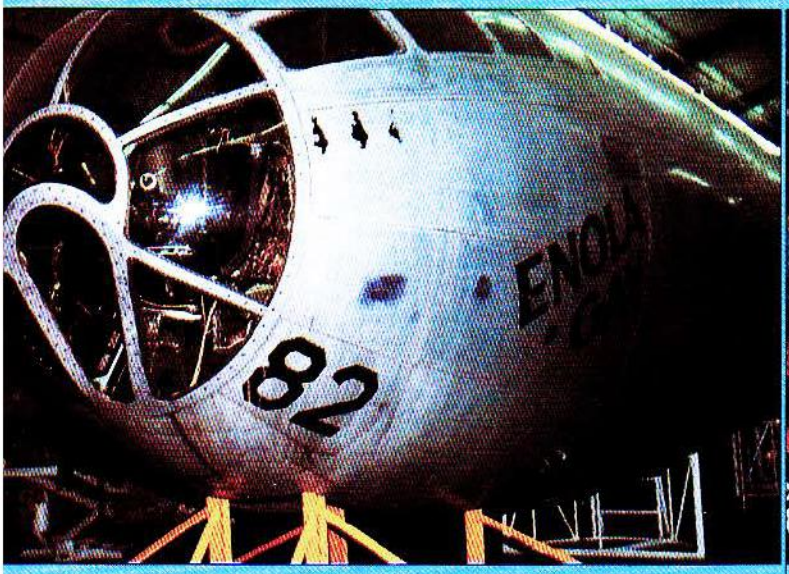
"Practically no one does what we do," says Egan. "It's a new area. We believe we are in the vanguard of what's becoming a very large movement to acquire and appreciate these flying machines. They are truly rare art objects—investment-grade collectibles. Just as one doesn't have to know how to paint to appreciate and own a collection of fine art, one needn't know how to fly to own one or more of these beautiful winged machines." While Warbird Salvors deals primarily in the search and

James Egan, president of WSI, is shown on an inspection flight of Progress Aviation's *DH 89 Rapide over Durban, South Africa.*

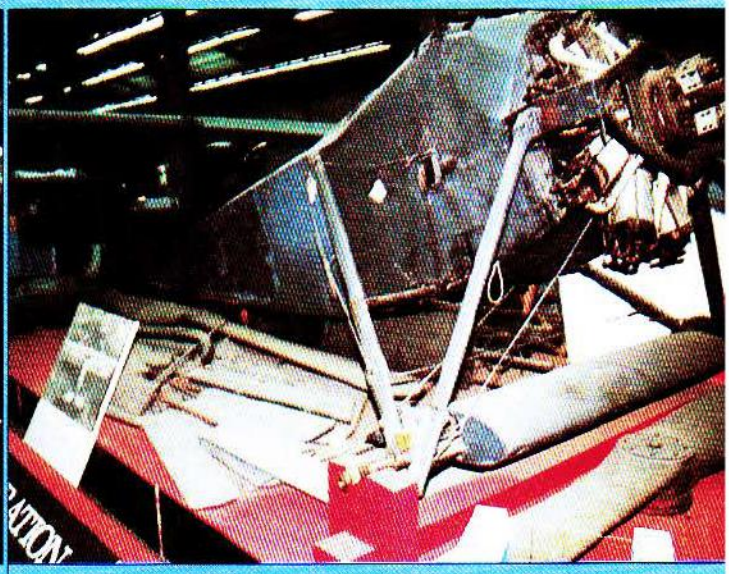
recovery process, the firm is also a repository of sightings as well as client needs and wants. "In some respects, we function like a fine-art or antiques dealer," says Egan.

However, in other respects, Warbird Salvors acts quite unlike most art dealers. On one expedition, Egan traveled to Oahu where he recovered a rare P-40B, shot down during the attack on Pearl Harbor. Unable to reach the wreckage on foot, Egan and his crew were dropped into the jungle site from helicopters. Once he verified what he had found, Egan proceeded with the engineering logistics to remove the wreck. A chopper, using a 150-foot cable and a cargo net, pulled the warbird from its nest and placed it in the nearest open field, 7 miles away, where it could be crated for return to the mainland. When restored, the rare bird will most likely be bought by a private collector. "If not for the private sector," says Egan, "a great many aircraft would be gone forever. Museum collections are greatly enhanced by private and corporate sponsors who partake in or finance recovery and restoration activities."

It all comes down to money. Today, it is the private or corporate sponsor who can afford the recovery and restoration of warbirds. The budgets of most museums cannot. "We are a commer-



Restoration of the Enola Gay is scheduled to take 5 years at the Paul E. Garber restoration facility of the National Air & Space Museum.



An unrestored display at the Garber Facility shows the challenge facing those who work on restoring aircraft.

Authenticity for All to See

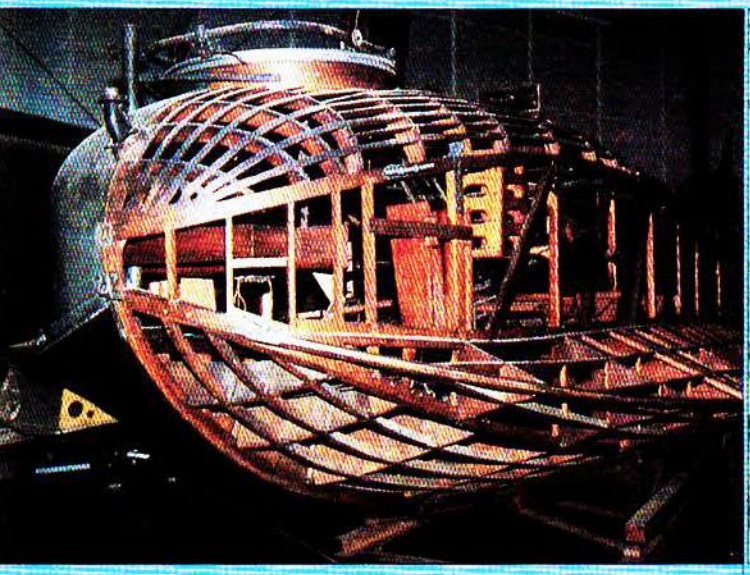
The story of the restoration and display of warbirds is really the story of the men and women who painstakingly and lovingly commit themselves to returning these machines to their original beauty. One institution that stands out in its scope and dedication is the National Air & Space Museum (NASM), a part of the Smithsonian Institution.

The NASM contains 23 exhibit areas containing such artifacts as the Wright brothers' original 1902 Flyer; Lindbergh's "Spirit of St. Louis"; and other examples of flight, from nineteenth-century observation balloons to the space shuttle. The museum is where these aircraft are displayed, but they are restored at NASM's Paul E. Garber Facility in Suitland, Md. There a labor of love goes on.

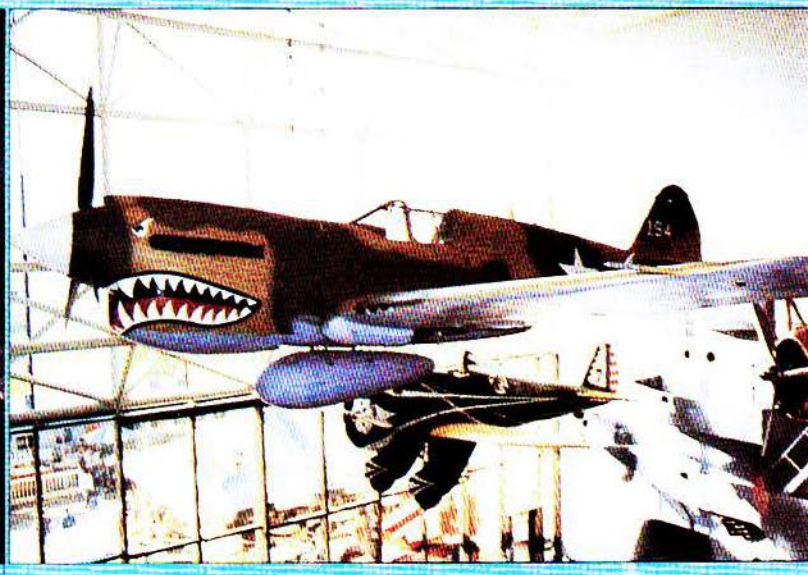
In its own way, the Paul E. Garber Facility is more impressive than the museum itself. In what NASM calls a "no frills" museum, the public can see not only the museum's reserve collection, but can catch a behind-the-scenes look at the restoration procedure by watching craftsmen who restore and preserve historic aircraft. In 25 buildings on 28 acres, sixteen restoration experts and ten staff personnel work at an average rate of 2.5 aircraft restorations per year, averaging between 5000 and

cial enterprise," says Egan. "Therefore, and in some cases regrettably, deciding to recover a particular plane must be a business decision. Although some valuable planes—in situ—may be located [Egan reports that his firm is aware of more than 3000 vintage planes worldwide], it must be commercially viable to recover them or we do not undertake the project. Such non-commercially viable projects have potential only for the person or corporation wanting a particular unit—cost, no object." In any event, once a warbird is in an owner's hands, it usually is shown to the public or, sometimes, donated to a public museum, such as the USAF Museum or the National Air & Space Museum in Washington. In this way, the public is ultimately served.

We can be grateful to those who are keeping the warbirds from extinction—those who recover, restore, sponsor, and make them available for us to see and learn—because, as Egan points out, "warbirds are tangible pieces of history. They personalize the commitments and sacrifices made by individual aviators and impress historical events and themes far better than any 2-dimensional medium."



A "flying boat" was used during World War I. It is a 1918 Felixstowe F-5L biplane.



This warbird, a P-40 Warhawk, is "frozen" in air as it hangs from the ceiling at the National Air & Space Museum, Washington, D.C.

13,000 man-hours per plane.

Two craftsmen are assigned to a project, which they stay with from start to finish. Usually there are four projects going on at any given time—two stick-and-fabric and two metal. A project can last from 6 months to 5 years or more (the Enola Gay will take at least 5 years to complete). All original parts or types are used, such as spark plugs, wiring, and hydraulic lines, and the restoration is so thorough that it is anticipated these planes will be on display 200 years from now. "At that time," notes docent Bob Wolff, "they will be the purest airplanes in the world." Total restoration is possible because the museum does not allow even the engines to be started—these aircraft are for display only.

As an example of authenticity, paint is removed from each plane by hand, wet-sanded layer-by-layer, to determine markings. Each set of markings dates the plane's history, and the craft can be restored to its original condition. Restoration is also performed using original technology whenever possible, that is, hand-painting rather than spraying, the way it was done in the first place. In this way, we can learn correctly—what we see and understand is what was.